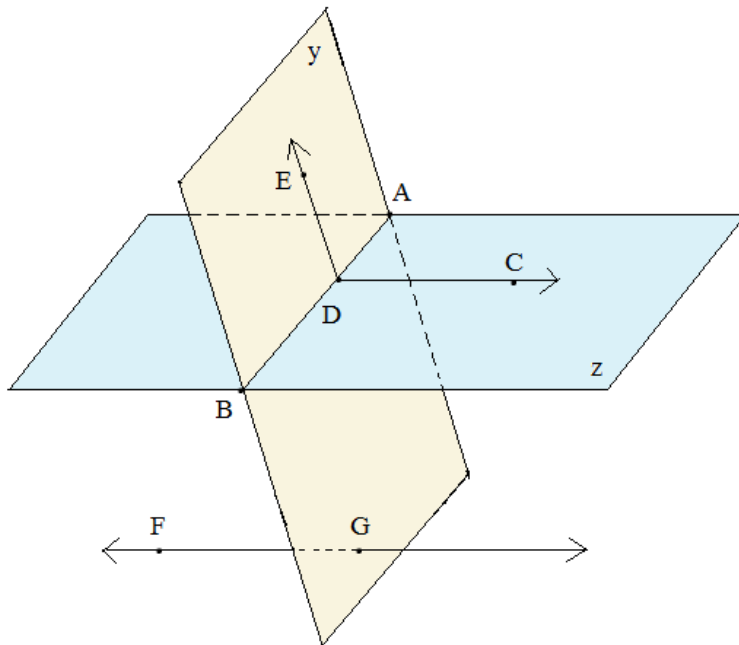






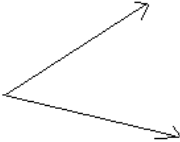

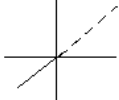
Geometry Introduction

Terms & Practice Questions (and solutions)



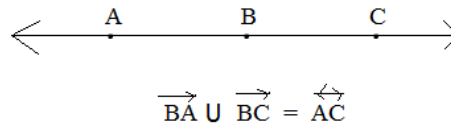
Topics include skew and parallel lines, clock angles, midpoints, complementary angles, always/sometimes/never, and more.

Basic Geometry Terms

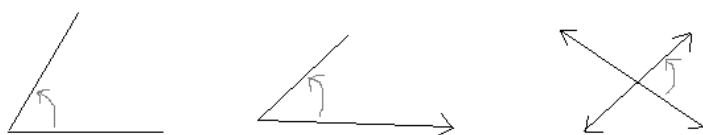
Point		"The exact position or location on a plane or in space" (Note: a point has no width or size)
(Line) Segment		"Collection of all points between 2 given points, including those 2 points"
Line		"A line segment that extends infinitely in both directions"
Ray		"Part of a line: it has an endpoint, and it extends infinitely in one direction"
Angle		"2 rays that share a common endpoint (vertex)"
Plane		"A flat surface that is infinitely large (extending in every direction) and has zero thickness"
Space		"A boundless 3-dimensional area; A plane with depth"

Observation: point ----> zero dimensions
 line ----> one dimension
 plane ----> two dimensions
 solid ----> three dimensions

2 rays in opposite directions form a line



an angle can consist of line segments, rays, and lines



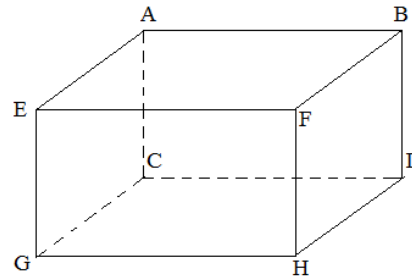
Basic Geometry Terms

Parallel lines	$l \parallel m$		These are coplanar, too... (i.e. on the same plane)
Perpendicular lines	$l \perp m$		
Skew lines	"2 lines that do not intersect and are not parallel"		line l is behind line m (they will never meet)

Try these:

1) In the rectangular solid, identify 3 pairs of:

- a) perpendicular lines
- b) parallel lines
- c) skew lines



2) Darken (or circle) the appropriate parts of the figure:

a) \overleftrightarrow{RS} c) \overrightarrow{SR}

b) \overrightarrow{RS} d) \overline{SR}

ANSWERS:

- a) perpendicular lines $\overline{AB} \perp \overline{BD}$ $\overline{AE} \perp \overline{EF}$ $\overline{GH} \perp \overline{HF}$ (and, there are several others)
- b) parallel lines $\overline{AC} \parallel \overline{BD}$ $\overline{EG} \parallel \overline{FH}$ $\overline{AB} \parallel \overline{CD}$ (in fact, all the vertical segments are parallel to each other. all the horizontal segments are parallel to each other.)
- c) skew lines \overline{EG} and \overline{CD} \overline{AB} and \overline{FH} \overline{EF} and \overline{BD} (and, there are several other pairs)

a) \overleftrightarrow{RS}

b) \overrightarrow{RS}

c) \overrightarrow{SR}

d) \overline{SR}

Notice, \overrightarrow{RS} is NOT the same as \overrightarrow{SR}

I. Answer the following:

Given: A, B, and D are collinear
C, B, and E are collinear

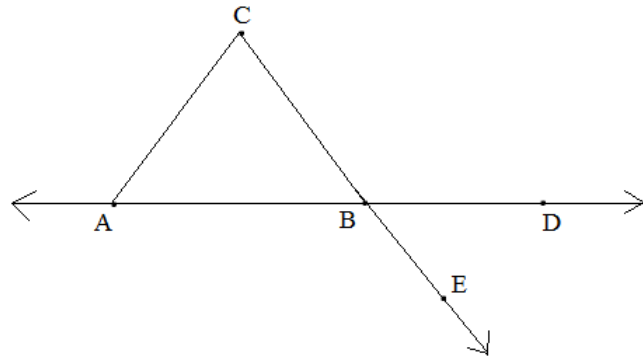
1) $\overline{AD} \cap \overline{CE}$ _____

2) $\overrightarrow{BD} \cap \overrightarrow{DA}$ _____

3) $\overrightarrow{BC} \cup \overrightarrow{BA}$ _____

4) $\overrightarrow{AB} \cap \overleftarrow{BD}$ _____

5) $\overline{AB} \cup \overline{DB}$ _____



II. Identify 4 angles with measure 40° :

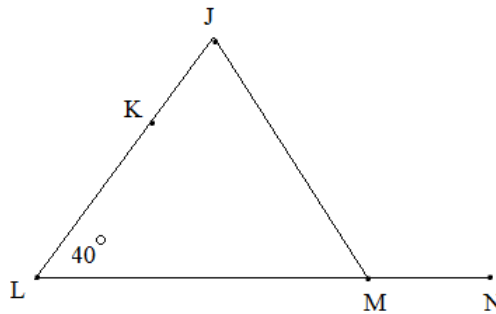
1. $\angle L$

2.

3.

4.

5.



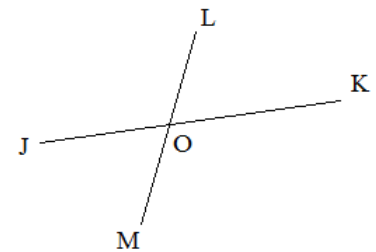
III. Answer the following:

- a) Given: $\overline{AD} = 18$
C is the midpoint of \overline{AD}
B is the midpoint of \overline{AC}

What is the length of BC?

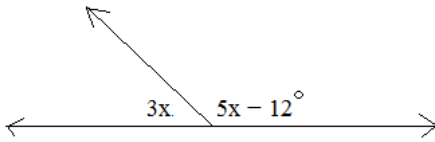
- b) \overline{JK} bisects \overline{LM}
 $JK = 16$
 $LM = 11$

What is the measure of \overline{LO} ?

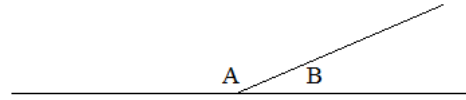


IV: Answer the following:

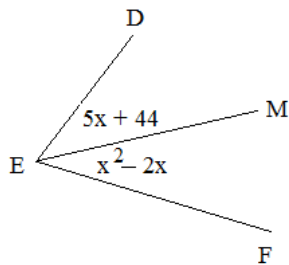
1) Find x:



2) The ratio of A to B is 5:1
What is the measure of angle B?



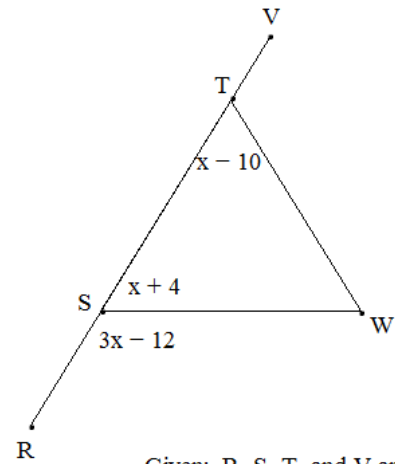
3)



Given: \overline{EM} bisects $\angle DEF$

What is the measure of $\angle MEF$?

4)



Given: $R, S, T,$ and V are collinear.

$$\angle RSW = 3x - 12$$

$$\angle TSW = x + 4$$

$$\angle STW = x - 10$$

What is the measure of $\angle VTW$?

5) Given: A and B are complementary angles

B and C are supplementary angles

$$\angle A = 37$$

What is $\angle C$?

V. *Always, Sometimes, Never:* Fill in the blanks

0) Two parallel lines are Always coplanar.

1) Two skew lines are _____ coplanar.

2) 2 opposite rays _____ form a line.

3) \overrightarrow{LM} and \overrightarrow{LP} are _____ the same ray.

4) \overrightarrow{LM} and \overrightarrow{ML} are _____ the same ray.

5) \overleftrightarrow{LM} and \overleftrightarrow{ML} are _____ the same line.

6) \overline{BX} and \overline{XB} are _____ the same segment.

7) If $\overline{AB} = 10$, $\overline{BC} = 6$, then \overline{AC} _____ equals 16.

8) The length of any segment is _____ less than any ray.

9) Two skew lines _____ share one point.

VI. Draw a diagram where

$$1) \overline{AB} \cap \overline{CD} = \overline{CB}$$

$$2) \overrightarrow{MN} \cup \overleftarrow{RM} = \angle RMN$$

$$3) \triangle ABC \cap \overline{DE} = C$$

$$4) \triangle ABC \cap \overrightarrow{MN} = F$$

$$5) \overleftrightarrow{JK} \cap \overleftrightarrow{PQ} = \emptyset$$

$$6) \overrightarrow{ST} \cup \overrightarrow{CD} = \overrightarrow{SC}$$

7) 3 coplanar points are non-collinear

8) 2 rays form a straight angle

$$9) \overrightarrow{MD} \cap \overrightarrow{RS} = K$$

VII. Sketch a diagram AND label.

1) \overrightarrow{AB} bisects \overline{MP} at point A

2) \overleftrightarrow{MN} and \overleftrightarrow{TS} are skew lines

3) J, K, L, M are coplanar points, and K, L, and M are collinear with L in between K and M.

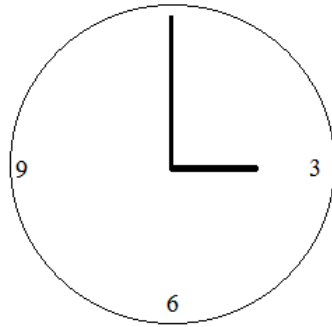
4) Sketch acute angle BID

5) The intersection of \overleftrightarrow{MN} and \overleftrightarrow{ST} is K
K is the midpoint of \overline{MN} and \overline{ST}
 $\overrightarrow{MS} \parallel \overrightarrow{NT}$
Circle N is tangent to ST

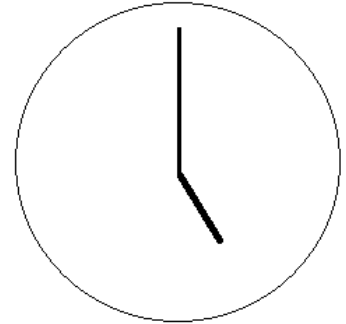
Measuring clock angles

In each clock, what is the angle measure between the hour and minute hands?

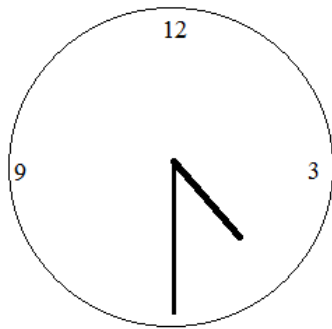
1) 3:00



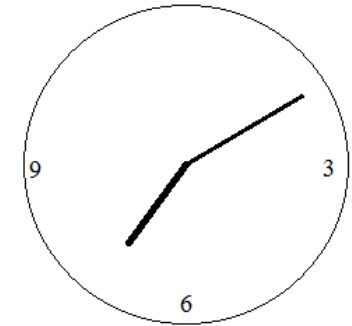
2) 5:00



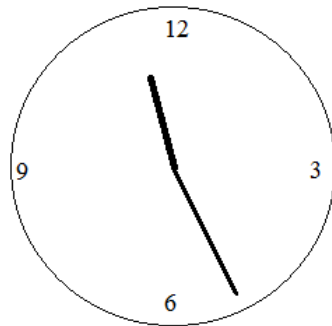
3) 4:30



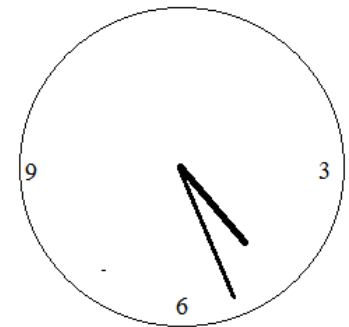
4) 7:12



5) 11:25

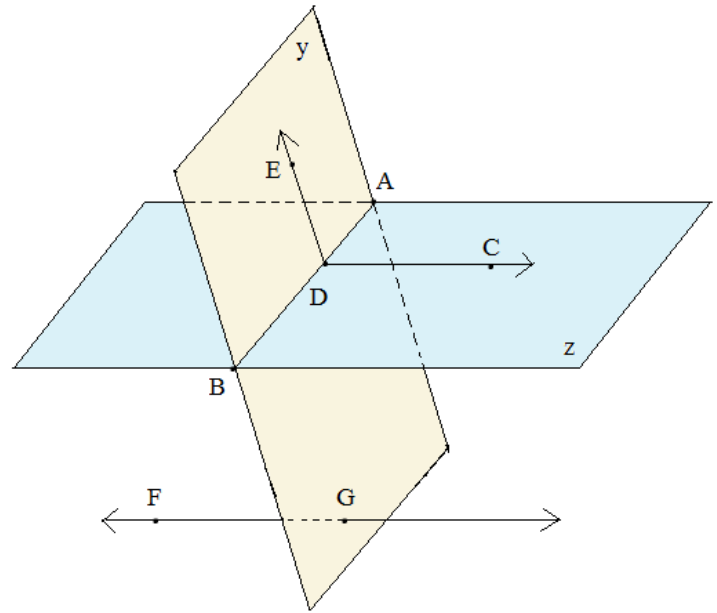


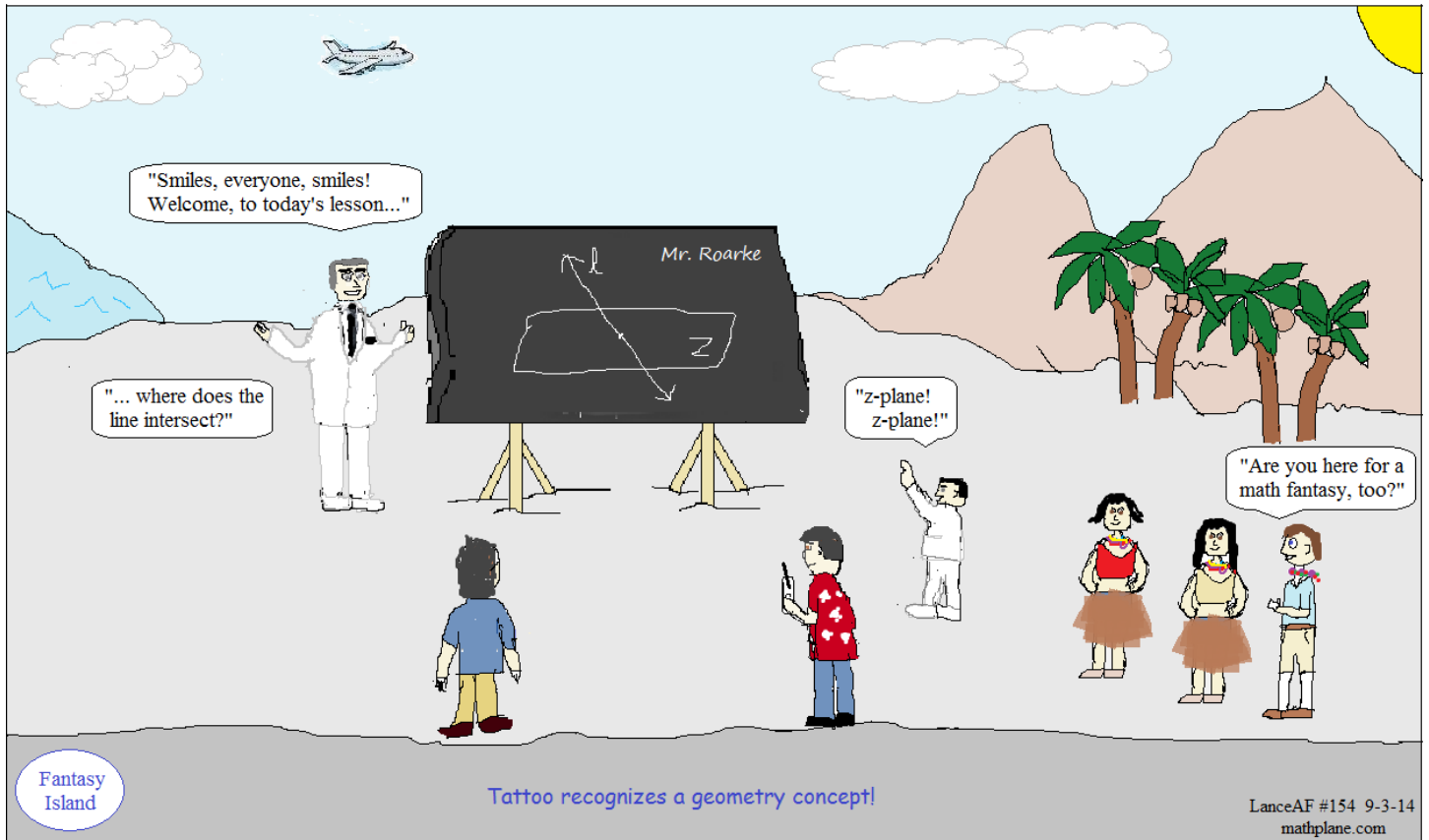
6) 4:25:30



Plane Geometry

- 1) Identify 3 collinear points
- 2) Select 3 non-collinear points and identify their plane
- 3) Answer the following:
 - a) $y \cap z$
 - b) $\overrightarrow{DE} \cup \overrightarrow{DC}$
 - c) $\overrightarrow{DE} \cap \overrightarrow{DC}$
- 4) Assume line FG is parallel to plane z ($\overleftrightarrow{FG} \parallel z$)
 - a) $\overleftrightarrow{FG} \cap y$
 - b) $\overleftrightarrow{FG} \cap z$





SOLUTIONS-→

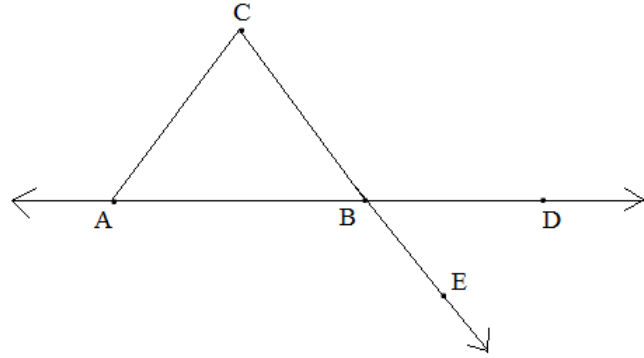
Basic Geometry terms and applications

SOLUTIONS

I. Answer the following:

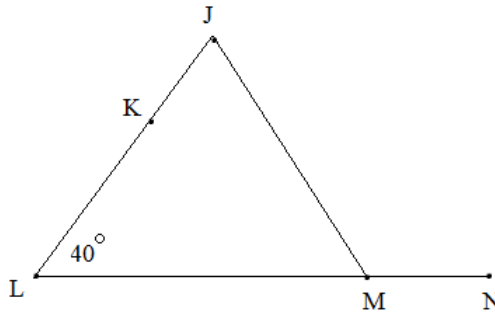
Given: A, B, and D are collinear
C, B, and E are collinear

- 1) $\overline{AD} \cap \overline{CE}$ B (point)
- 2) $\overrightarrow{BD} \cap \overrightarrow{DA}$ \overline{BD} (segment)
- 3) $\overrightarrow{BC} \cup \overrightarrow{BA}$ $\angle CBA$ or $\angle ABC$
- 4) $\overrightarrow{AB} \cap \overleftarrow{BD}$ \overrightarrow{AB} (line BD is same as line AD)
- 5) $\overline{AB} \cup \overline{DB}$ \overline{AD}



II. Identify 4 angles with measure 40° :

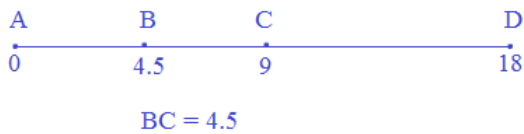
1. $\angle L$
2. $\angle JLM$
3. $\angle JLN$ L is the vertex
4. $\angle KLM$
5. $\angle KLN$



III. Answer the following:

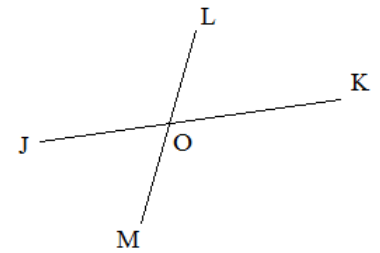
- a) Given: $\overline{AD} = 18$
C is the midpoint of \overline{AD}
B is the midpoint of \overline{AC}

What is the length of BC?



- b) \overline{JK} bisects \overline{LM}
 $JK = 16$
 $LM = 11$

What is the measure of \overline{LO} ?



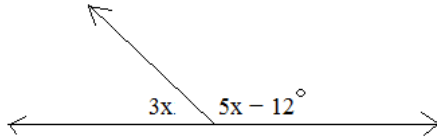
Since JK bisects LM at point O, \overline{LO} is $1/2(LM)$...

$$LO = 1/2(11) = 5 \frac{1}{2}$$

IV: Answer the following:

SOLUTION

1) Find x:



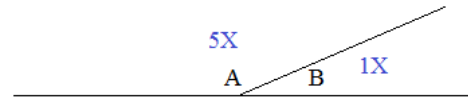
supplementary angles add up to 180

$$\begin{aligned} 3x + (5x - 12) &= 180 \\ 8x - 12 &= 180 \\ 8x &= 192 \\ x &= 24 \end{aligned}$$

Check: $3(24) = 72$
 $5(24) - 12 = 108$
 $72 + 108 = 180$ ✓

2) The ratio of A to B is 5:1

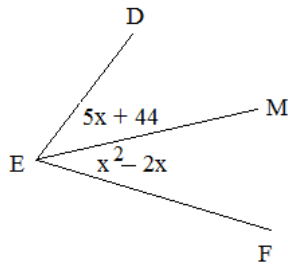
What is the measure of angle B?



$$\begin{aligned} 5X + 1X &= 180 \\ 6X &= 180 \\ X &= 30 \end{aligned}$$

$$\begin{aligned} A &= 5(30) = 150 \\ B &= 1(30) = 30^\circ \end{aligned}$$

3)



Given: \overline{EM} bisects $\angle DEF$

What is the measure of $\angle MEF$?

Since EM bisects, $\angle DEM = \angle MEF$

$$5x + 44 = x^2 - 2x$$

$$x^2 - 7x - 44 = 0$$

$$(x - 11)(x + 4) = 0$$

$$x = -4 \text{ or } 11$$

$$x = -4$$

$$5(-4) + 44 = 24$$

$$(-4)^2 - 2(-4) = 24$$

$$x = 11$$

$$5(11) + 44 = 99$$

$$(11)^2 - 2(11) = 99$$

$$\angle MEF \text{ is } 24 \text{ or } 99$$

5) Given: A and B are complementary angles

B and C are supplementary angles

$$\angle A = 37$$

What is $\angle C$?

$$A + B = 90$$

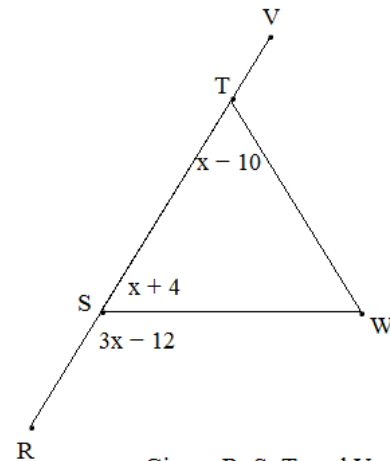
$$B + C = 180$$

$$A = 37$$

Since $A = 37$, then $B = 53$

Therefore, $53 + C = 180$... So, $C = 127^\circ$

4)



Given: R, S, T, and V are collinear.

$$\angle RSW = 3x - 12$$

$$\angle TSW = x + 4$$

$$\angle STW = x - 10$$

What is the measure of $\angle VTW$?

Angles TSW and RSW are supplementary:

$$(x + 4) + (3x - 12) = 180$$

$$4x - 8 = 180$$

$$4x = 188$$

$$x = 47$$

$$\text{If } x = 47, \text{ then angle } STW = (47) - 10 = 37$$

Since VTW and STW are supplementary,

$$VTW + (37) = 180$$

$$VTW = 143$$

V. *Always, Sometimes, Never*: Fill in the blanks

SOLUTIONS

0) Two parallel lines are Always coplanar.

1) Two skew lines are Never coplanar.

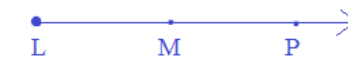
Skew lines never meet and they 'go in different directions'

2) 2 opposite rays Always form a line.

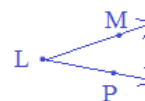


3) \overrightarrow{LM} and \overrightarrow{LP} are Sometimes the same ray.

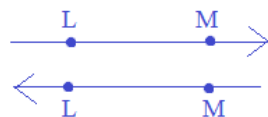
Yes, if L, M, and P are collinear..



No, if they are not collinear..



4) \overrightarrow{LM} and \overrightarrow{ML} are Never the same ray.



Different directions...

5) \overleftrightarrow{LM} and \overleftrightarrow{ML} are Always the same line.

6) \overline{BX} and \overline{XB} are Always the same segment.

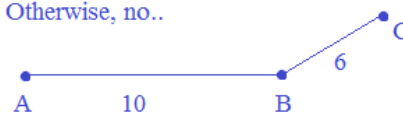
7) If $\overline{AB} = 10$, $\overline{BC} = 6$, then \overline{AC} Sometimes equals 16.

Yes, if A, B, and C are collinear...



8) The length of any segment is Always less than any ray.

Otherwise, no..



9) Two skew lines Never share one point.

A ray goes infinitely in one direction; whereas, the segment will stop eventually...

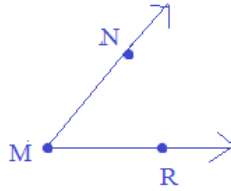
VI. Draw a diagram where

Possible SOLUTIONS

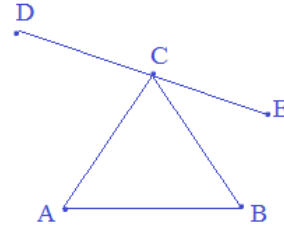
1) $\overline{AB} \cap \overline{CD} = \overline{CB}$



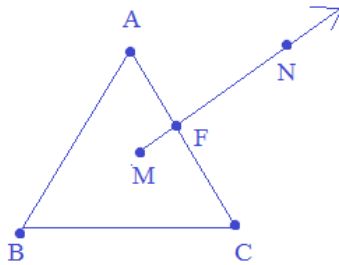
2) $\overrightarrow{MN} \cup \overleftarrow{RM} = \angle RMN$



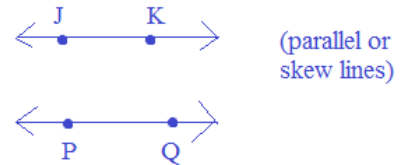
3) $\triangle ABC \cap \overline{DE} = C$



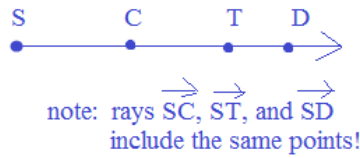
4) $\triangle ABC \cap \overrightarrow{MN} = F$



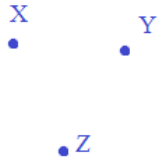
5) $\overleftrightarrow{JK} \cap \overleftrightarrow{PQ} = \emptyset$



6) $\overrightarrow{ST} \cup \overrightarrow{CD} = \overrightarrow{SC}$

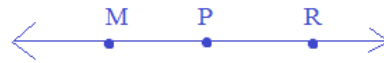


7) 3 coplanar points are non-collinear



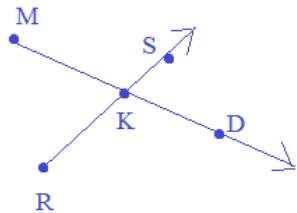
\overrightarrow{PM} and \overrightarrow{PR}

8) 2 rays form a straight angle



'straight angle' is 180 degrees

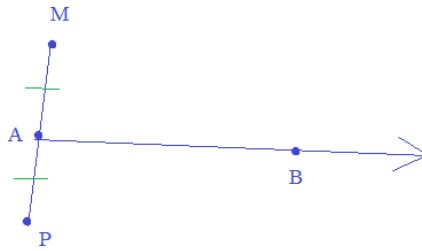
9) $\overrightarrow{MD} \cap \overrightarrow{RS} = K$



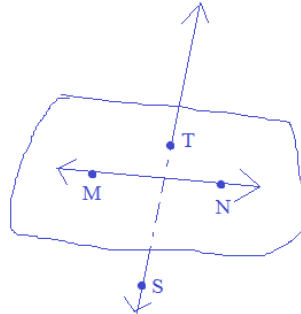
VII. Sketch a diagram AND label..

SOLUTIONS

1) \overrightarrow{AB} bisects \overline{MP} at point A



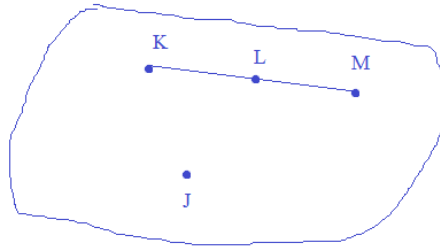
2) \overleftrightarrow{MN} and \overleftrightarrow{TS} are skew lines



In this solution, M, N, and T are in the same plane. and, S is under the plane..

MN and TS do not intersect; and, they are not parallel

3) J, K, L, M are coplanar points, and K, L, and M are collinear with L in between K and M.

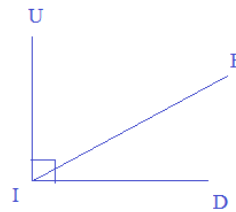


4) Sketch acute angle BID

An acute angle must be between 0 and 90 degrees...

How can the diagram guarantee it's acute? \Rightarrow

construct a 90 degree angle... then, place angle BID inside!

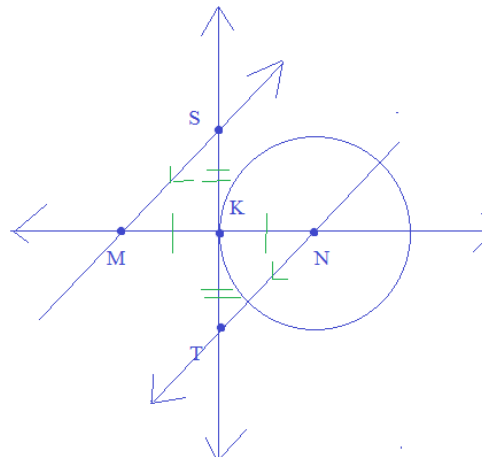


5) The intersection of \overleftrightarrow{MN} and \overleftrightarrow{ST} is K

K is the midpoint of \overline{MN} and \overline{ST}

$\overrightarrow{MS} \parallel \overrightarrow{NT}$

Circle N is tangent to ST



one possible answer

Measuring clock angles

SOLUTIONS

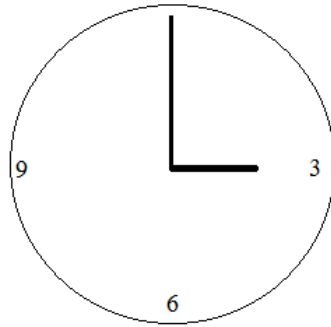
In each clock, what is the angle measure between the hour and minute hands?

1) 3:00

right angle;

1/4 of the clock

90°



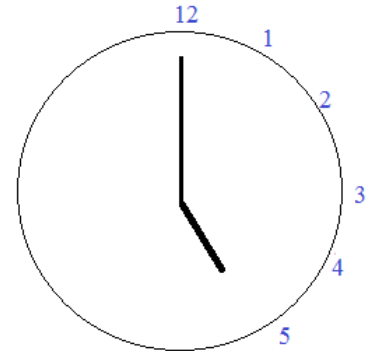
2) 5:00

big hand is on the 12
small hand is on the 5

The angle represents
5/12 of the circle

$$5/12 \cdot 360^\circ = 150^\circ$$

(*Note: 30 degrees
between each hour)

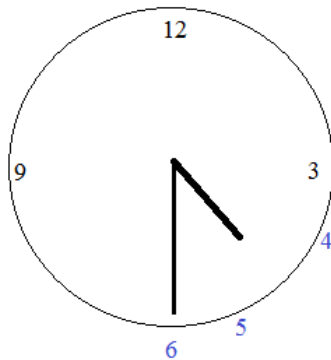


3) 4:30

At half past the hour,
the *hour hand* is half way
between 4 and 5.

The angle between 5 and 6
is 30 degrees...
and, the angle between
4 1/2 and 5 is 15 degrees!

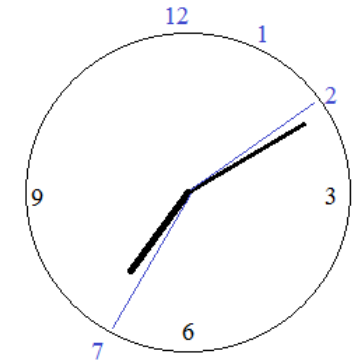
So, the total angle is 45°



4) 7:12

At 7:00, the hour hand is
on the 7. At 12 minutes
after, the *hour hand*
moves 12/60 of the
distance between 7 and
8..

The angle between 2
and 7 is 150 degrees..
the minute hand is 12
degrees past..
and, the hour hand is 6
degrees past...



144 degrees

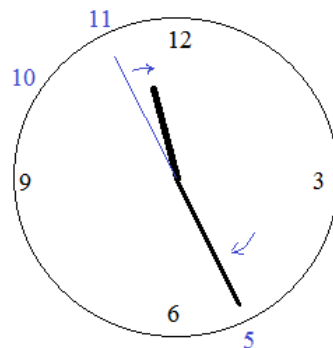
5) 11:25

The angle between 11 and
5 is a straight angle (180
degrees);

At 25 minutes past, the
hour hand moves 25/60
of the way from 11 to 12.

$$25/60 \cdot (30) = 12.5 \text{ degrees}$$

$$180 - 12.5 = 167.5 \text{ degrees}$$



6) 4:25:30

there are 3600 seconds
per hour...

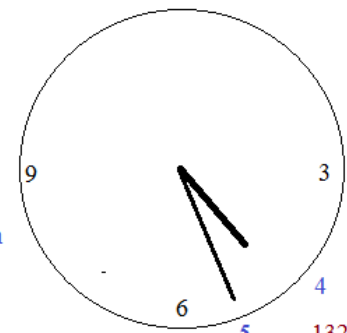
25:30 is 1530 seconds
past the hour...

Therefore, the hour hand
has moved

$$\frac{1530}{3600} \text{ of the distance between } 4 \text{ and } 5$$

So, it has moved .425 of
the 30 degrees between
the 4 and the 5...

$$132.75$$



153

132.75

there are 60 minutes per hour...

At 25:30, the minute hand has moved

$$\frac{1530}{3600} \text{ of the way around the clock}$$

$$.425 \times 360 = 153^\circ$$

Note: at 4: 120 degrees
at 5: 150 degrees

20.25°

- 1) Identify 3 collinear points (3 points that lie on the same line)

A-D-B

- 2) Select 3 non-collinear points and identify their plane

Examples: E-D-G (plane y)
 B-D-C (plane z)
 F-D-C (not labeled)

- 3) Answer the following:

a) $y \cap z$ \overleftrightarrow{AB} (or \overleftrightarrow{BD} or \overleftrightarrow{AD})
 (intersecting planes form a line)

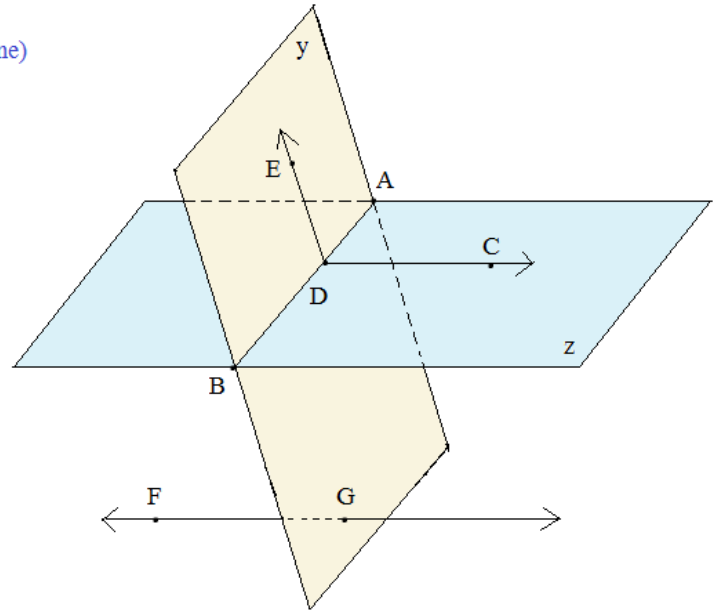
b) $\overrightarrow{DE} \cup \overrightarrow{DC}$ $\angle EDC$
 (2 rays that share the same endpoint form an angle)

c) $\overrightarrow{DE} \cap \overrightarrow{DC}$ The point D
 (The only common point of the rays)

- 4) Assume line FG is parallel to plane z ($\overleftrightarrow{FG} \parallel z$)

a) $\overleftrightarrow{FG} \cap y$ Point G (The line goes through point G)

b) $\overleftrightarrow{FG} \cap z$ \emptyset (Since they are parallel, there is no intersection)



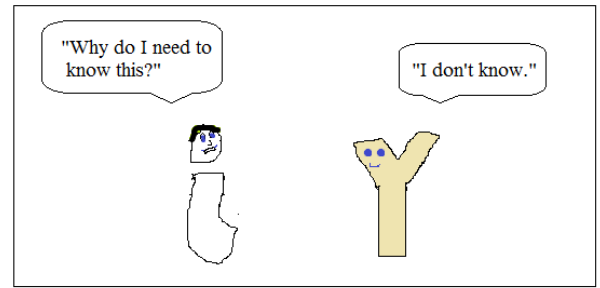
Why?!?

It's often asked: why do we need to know this?

why are we doing proofs?

What does this have to do with triangles?

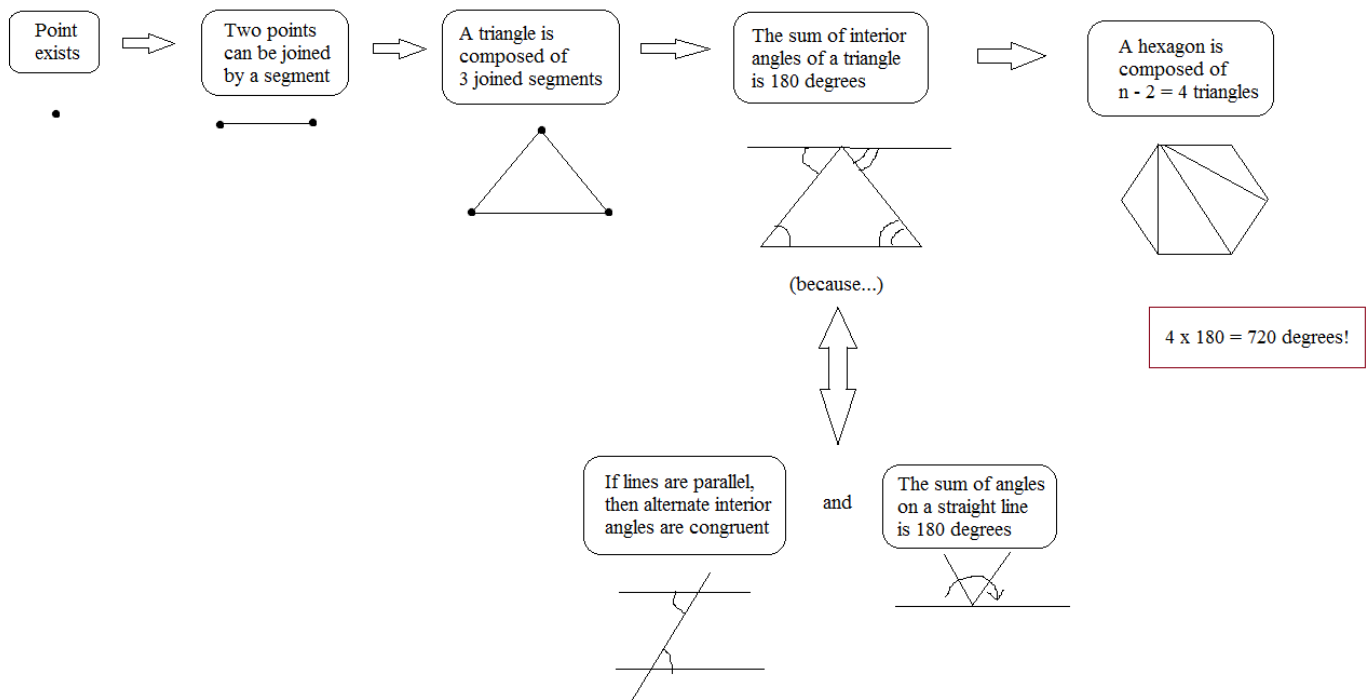
and, other student questions!



One explanation is to recognize that "geometry builds on itself".

We need logic and reasoning to lead to theorems and conclusions. (postulates and theorems)

Example: How do we know the sum of the interior angles of a hexagon is 720 degrees?



Using basic concepts and logic, we can develop more complex conclusions!

Thanks for visiting!

If you found this exercise useful, check out other practice tests, notes, comics, and more!

www.mathplane.com or mathplane.ORG for mobile.

Questions, suggestions, and feedback are always appreciated....

Cheers,

Lance

